

NASA Facts

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center



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NASA TECHNOLOGY SPINOFFS: *Bringing Space Down to Earth*

Do you feel like an astronaut when you go to the grocery store? How about when you set your watch?

The next time you reset the smoke detector in your home, take a minute to imagine it as part of your own spacecraft's caution and warning system. Because before they saved lives on Earth, that's where smoke detectors were found — on spacecraft designed and built by NASA.

Although NASA's most visible achievements have taken place in space, the technologies that put men on the moon, launched space shuttles and will build a space station have found their way into everyday life on Earth.

These common secondary uses, called space spinoffs, have continuously enhanced the lifestyle of Americans and strengthened the U.S. economy since the 1950s.

The technologies that led to the computer bar codes in retail stores, quartz timing crystals and household smoke detectors were originally developed for NASA.

NASA technology has provided many benefits to the medical field. The pacemakers used to treat cardiac patients as well as the remote monitoring devices for intensive care



Technologies developed for NASA to meet the challenges of space exploration have found more than 30,000 secondary commercial uses in products ranging from tennis shoes to medical equipment, bar codes, pacemakers and sunglasses.

patients were derived from the telemetry systems that first monitored astronauts and spacecraft. Much of the portable medical equipment carried aboard ambulances has its roots in NASA's needs for such portable equipment in space.

These are but a few of the more than 30,000 secondary applications of space technology providing daily benefits in Earth-bound hospitals, offices and homes.

In the past, such spinoffs often happened by chance — a coincidence when practical uses of new technologies were found.

NASA is now seeking to make the spinoff a part of the product itself.

Working jointly with private industry to develop technologies that have a use in space and on Earth lessens the cost of development for NASA, and, ultimately, the taxpayer.

PAST NASA SPINOFFS



Fabrics... NASA's use of aluminized materials to serve as insulation for satellites and spacecraft helped lead to a revolution in reflective insulating materials ranging from survival blankets to wraps for water heaters to new types of interior home insulation. Extremely strong fire-retarding materials that were developed for use in the

pure-oxygen air of early spacecraft have led to a host of cloths, such as Beta Glass, used in fireproof clothing, accessories and firefighter's suits. Other spacecraft materials have included teflon-coated fibers with extremely light weight but great strength that have been used as roofing material for such structures as the Detroit Silverdome and the Jeddah, Saudi Arabia, Airport.

Materials... Composite materials, a mix of fibers and resins designed to provide great strength yet remain very light weight, have been synonymous with all aerospace applications from airplanes to NASA spacecraft and have advanced into lightweight, strong materials for helmets, tennis rackets and other sporting goods. NASA spawned further development of "memory metals," metals that remember their former shape when bent, in its early space station studies and advanced forms of the materials are now used in common flexible metal eyeglass frames. Other glasses benefit from scratch-resistant coatings originally developed as a protective coating for delicate spacecraft parts. In footwear, a shock-absorbing "spacer" technique originally developed for the boots of moonwalking astronauts has given birth to an entire new family of shock-absorbing tennis shoes and other athletic shoes.



Electronics... The smoke detectors now required by law to be placed in all homes and universally credited with saving countless lives are an end result of a technology originally developed for NASA's early 1970s Skylab spacecraft. Quartz timing crystals which have led to the current status quo in wristwatches and small

clocks were first developed for NASA as a highly accurate, lightweight and durable timing device for the lunar-bound Apollo spacecraft. On the moon, astronauts used specially developed portable, battery-powered electric tools to drill into the surface and take samples of the crust, tools that were the direct predecessor of today's cordless screwdrivers, drills and other rechargeable power tools. Common bar codes now used for pricing in supermarkets are an advancement of technology originally developed for uses within NASA, such as maintaining a highly accurate inventory of millions of spacecraft parts.

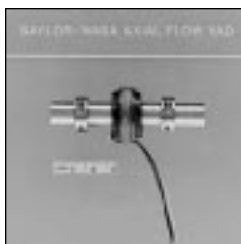
CURRENT TECHNOLOGIES



Bioreactor... A cell culture device developed as part of space medicine research at JSC may allow scientists to better test new treatments for cancer and viruses without risking harm to patients. The rotating wall bioreactor, a cell culture device that was developed as part of space medicine research at JSC, mimics the effect

weightlessness may have on cell cultures by incorporating a rotating cylinder to hold the culture. With its rotation, pressure points on the growing cells are relieved and the device can grow three-dimensional, highly accurate tissues, unlike previous culture growths which grew in two dimensions. Already being commercialized by a small company in Houston, the device has been used to grow more than 35 cell types and no cell type yet tested has not grown well in the system. The bioreactor may add a valuable new tool to the arsenal of medical research.

Zeolite soil... The study of how to grow plants in the most inhospitable location yet visited by humans — the moon — led to the development of a synthetic soil by JSC researchers that holds promise as a revolutionary fertilizer and soil on Earth. The zeolite soil mix takes advantage of the natural properties of a common mineral called zeolite in storing and time-releasing nutrients. A JSC-developed additive is mixed with the specially prepared zeolite to create a soil that in laboratory testing has produced conditions almost comparable to the fertility provided by hydroponics, a well-known technology that uses water to provide plants with a precise nutrient mixture. However, unlike hydroponics, the zeolite soil does not require massive pumps and pipes. The zeolite mixture already is being commercialized by two U.S. companies and may provide a valuable new fertilizer that, due to its time-release properties, avoids runoff pollution, a common symptom of current agricultural fertilizers, as well as providing high fertility.



Implantable heart pump...

NASA's expertise in tiny yet highly reliable pumps may provide an alternative to the large, external heart pumps used by patients awaiting a heart transplant. JSC has combined forces with the Baylor College of Medicine and famed heart surgeon Dr.

Michael DeBakey to make use of the center's expertise in developing the Ventricular Assist Device. The new generation of heart pump already is undergoing implant tests in animals and, if they continue to go well, a first human implant may come soon. The pump would allow critical heart patients a much more convenient alternative to the heart pumps currently in use.